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इस भाग में भिन्न पृष्ठ संख्या दी जाती है जिससे कि यह अलग संकलन के रूप में रखा जा सके।
Separate paging is given to this Part in order that it may be filed as a separate compilation.

MINISTRY OF LABOUR AND EMPLOYMENT

NOTIFICATION

New Delhi, the 14th December 1965

S.O. 3922.—In pursuance of section 27 of the Mines Act, 1952 (35 of 1952) the Central Government hereby publishes the report submitted to it under sub-section (4) of section 24 of the said Act by the Court of Inquiry appointed under that section by the notification of the Government of India in the Ministry of Labour and Employment No. M. 1-2/1/65, dated the 14th June 1965 to hold an inquiry into the causes of and circumstances attending the accident which occurred in the early hours of 28th May, 1965 in the Dhori Colliery, Bermo P.O., Hazaribagh Dist., Bihar.

REPORT OF ENQUIRY INTO THE DHORI COLLIERY DISASTER, 1965.

By

Mr. S. K. DAS

Retired Judge of the Supreme Court, India

Assessors

1. Mr. P. K. Ghosh, Superintending Geologist, Geological Survey of India.
2. M. S. C. Dey, Director, Planning and Production, National Coal Development Corporation.
3. Mr. B. H. Engineer, Coal Adviser, Tata Iron & Steel Co. Ltd.

26th November, 1965

REPORT OF ENQUIRY INTO THE DHORI COLLIERY DISASTER OF 1965

PART I

Introductory:

On the night between the 27th and 28th of May, 1965, at about 1 A.M., one of the biggest disasters in the history of the coal mining industry in this country took place in a colliery known as the Dhori Colliery, which is situate at a distance of about 80 Kilometres from Dhanbad in the State of Bihar. It has been stated before that the verification of the Attendance Registers and other enquiries revealed that of the total number of workers shown to be on employment in the Attendance Registers at the relevant time, 267 were missing and were believed to have been killed in the disaster. It was later revealed that the name of one night guard who was killed outside Amlo Incline was not shown in any of the registers and was, therefore, not included in the figure given above. Thus, the total number of workers killed came to 268. At the conclusion of the rescue operations which were commenced within a few hours of the disaster, the total number of dead bodies recovered was 252 till June 1, 1965. Some dead bodies were recovered later and the number of postmortem examination reports which were placed before the Court of Enquiry was 259.

Constitution of the Court of Enquiry:

2. On June 14, 1965, the Government of India in the Ministry of Labour and Employment, issued a Notification which stated that the Central Government was of opinion that a formal enquiry into the causes of and circumstances attending the accident ought to be held; therefore, under Section 24 of the Mines Act, 1952 (35 of 1952) the said Government appointed me to hold such an enquiry and also appointed three Assessors to assist me. The Assessors who have helped me throughout the enquiry are (1) Sri P. K. Ghosh, Superintending Geologist, Geological Survey of India, (2) Sri S. C. Dey, Director, Planning and Production, National Coal Development Corporation, and (3) Sri B. H. Engineer, Coal Adviser, Tata Iron and Steel Co., Ltd.

Procedure followed in the enquiry under Rule 21 of the Coal Mines Rules, 1955:

3. On June 19, 1965 the Court of Enquiry issued a general notice to all persons or associations or bodies interested in the enquiry to be present, either personally or through a representative, at a preliminary sitting of the Court of Enquiry to be held on July, 2, 1965 at the Mines Rescue Station, Dhansar, Dhanbad. Before the preliminary sitting and with notice to the parties concerned, the Court of Enquiry, along with the three Assessors, visited the colliery on June 26, 1965 and June 27, 1965. An inspection of the workings was made on those two dates in the presence of some representatives of the Management and representatives of some of the Trade Unions concerned. A Memorandum of Inspection was prepared for each of the two inspections, and these memoranda were circulated to the parties.

4. On June 28, 1965 certain directions were sent to the Chief Inspector of Mines; one of these directions was to the effect that all the electrical apparatus in the mine should be examined by the Electrical Inspector of Mines along with the representatives of the Management to ascertain if there was sign of any fault in the electrical system which might be responsible for the explosion, and also to ascertain any external or internal damage done to the apparatus as a result of the explosion; the second direction was that the accumulated gas (CH_4) in No. 15 and No. 16 south levels of BI. 10A Incline and also in the old cross-cut dip be cleared by providing mechanical ventilators, and as soon as the galleries were completely cleared of all gas or as soon as the gas percentage was substantially reduced, information be sent to the Court and the Assessors so that an inspection might be made as to the accumulation of gas in those galleries after the removal of the mechanical ventilators. These directions were carried out by the Chief Inspector of Mines, and on June 30, 1965 one of the Assessors (Sri S. C. Dey) inspected BI. 10A Incline and found that by 11 A.M. all gas had been cleared. The subsequent accumulation of gas between the dates July 1, 1965 and July 8, 1965 has been referred to in the evidence of O. N. Saksena (witness No. 5 for the Chief Inspector of Mines). The Electrical Inspector attached to the Office of the Chief Inspector of Mines submitted his report after a thorough examination of the electrical apparatus, at the surface as well as underground. This report is part of the evidence in the enquiry.

5. The date of preliminary sitting was advanced from July 2, 1965 to July 1, 1965 in consultation with the parties. At the preliminary sitting the following parties entered appearance before the Court of Enquiry: (1) the Management; (2) the Department of Mines; (3) Indian Mine Managers' Association; (4) the Indian National Trade Union Congress and the Colliery Mazdoor Sangh affiliated to it; (5) Indian Mine Workers Federation; (6) Hind Mazdoor Sabha; (7) Indian National Mines Overman, Sirdar and Shotfirer's Association; and (8) Bihar Coal Miners' Union of United Trade Union Congress. Subsequently, the State of Bihar also entered appearance on July 2, 1965.

6. The following directions were given at the preliminary sitting: (1) the parties were directed to file appearance slips giving therein the names of lawyers or representatives who would represent the party and the address to which any communication meant for the party should be sent; (2) each party was directed to file 10 copies (later, the number was increased to fifteen) of a Statement of the Case showing therein: (i) the interest of the party in the Enquiry; (ii) the exact information and data which the party wished to place before the Court of Enquiry; (iii) the conclusions which, according to the party, followed from the information or data available; (iv) names and other particulars of witnesses which the party wished to be examined; and (v) documents which the party wished to file or call for; (3) directions as to inspection of documents; (4) directions as to examination of witnesses; (5) direction as to where the Court of Enquiry would sit; and (6) directions as to where communications meant for the Court of Enquiry should be sent.

7. On July 27, 1965 the Management filed a petition for staying the proceedings of the Court of Enquiry till the disposal of a criminal case which, it was stated, had been instituted against some persons of the Management. This petition was taken up for hearing on July 28, 1965. However, as some of the parties had not received a copy of the petition, its hearing was adjourned till August 9, 1965, on which the petition was heard and dismissed.

8. On August 10, 1965 all the parties, except the Management, filed their Statements of the Case. The Management moved the High Court against the order of the Court refusing to stay the proceedings before it. The High Court rejected the petition of the Management on August 18, 1965.

9. On August 30, 1965 the Management filed its Statement of the Case, purporting to be a Statement on behalf of (I) M/s. Bokaro and Ramgur Ltd., (II) M/s. Sarangarh Coal Co. (Dhori), Raising-*cum*-Selling Contractors, and (iii) Kailash Pati Singh, nominated owner of Dhori Colliery. The Court accepted this Statement of the Case, even though it was filed beyond the time originally fixed for filing Statements of the Case.

10. The examination of witnesses commenced on August 30, 1965 and continued till September 6, 1965. On that date a request was made on behalf of all the parties for an adjournment of the case on the ground of the situation arising out of Pakistani aggression on India. The case was then adjourned to October 11, 1965.

11. The Court of Enquiry resumed its sittings on October 11, 1965, and the examination of witnesses proceeded from day to day till October 16 1965 on which date the examination of witnesses was concluded, including the examination of two witnesses as Court witnesses. Arguments commenced on October 19, 1965. The Management made a prayer that arguments be postponed because the Management was unable to secure the services of its Counsel within the short time allowed. This prayer was rejected. Arguments on behalf of all the other parties concluded on October 22, 1965. On October 21, 1965 the Court decided, in consultation with the Assessors and after discussion with the parties, that another opportunity be given to the Management to make its submissions if it so desires, and a telegram was accordingly sent to the Management inquiring if it would avail itself of such an opportunity. A reply was received on October 22, 1965 from M|s. Bokaro & Ramgur Ltd. that the Management would be glad to have such an opportunity. Therefore, November 10 and 11, 1965 were fixed for arguments by the Management. These arguments were heard on those dates.

12. After hearing the evidence and the submissions made on behalf of all parties, the Court of Enquiry is now submitting its Report on "the causes of and circumstances attending the accident". The Court of Enquiry has had full assistance from the Assessors throughout the proceedings, and it is a matter of great satisfaction to the Court that the report is unanimous and has the concurrence of the Assessors. The Court expresses its deep sense of gratitude for the help which it has received from them. At every stage of the enquiry the Assessors have

placed at the disposal of the Court their mature experience and technical knowledge in an unstinted measure.

A short history of the Dhori Colliery, its geology and the method of working followed in winning coal:

13. It is necessary to give a short history of the Dhori Colliery, its geology, and the method of working followed in winning coal. To the west of Jharia coalfield is situated, in the district of Hazaribagh of Bihar, an extensive and significant coalfield known as the Bokaro coalfield. The coalfield derives its name from the Bokaro river which meanders through this field. It is one of the most important fields for metallurgical coal resources.

14. The area of the coal field is approximately 466 sq. kms. (180 sq. miles). It extends over a length of 64.4 kms. (40 miles) and has a maximum width of 11.3 kms. (7 miles). The Lugu hill which forms a prominent landmark divides the field into two parts *viz.*, the east Bokaro field and the west Bokaro field. The east Bokaro field has an area of 207 sq. kms. (80 sq. miles), while the west Bokaro field has an area of 259 sq. kms. (100 sq. miles).

15. Dhori Colliery is situated on the eastern part of the east Bokaro coalfield. According to the memoirs of the Geological Survey of India, the coalfield was examined by D. H. Williams in 1846-47. It was later surveyed by T. H. Hughes in 1866-67. A thorough re-survey of the field was undertaken by A. B. Dutt, Superintending Geologist, Geological Survey of India, in 1944-51. The east Bokaro coalfield has as many as 29 coal seams of which 19 are of thickness greater than 1.2 m. (4 ft.) each. In Dhori Colliery, however, only the lower seams are exposed, the sequence of which is given below in the descending order.

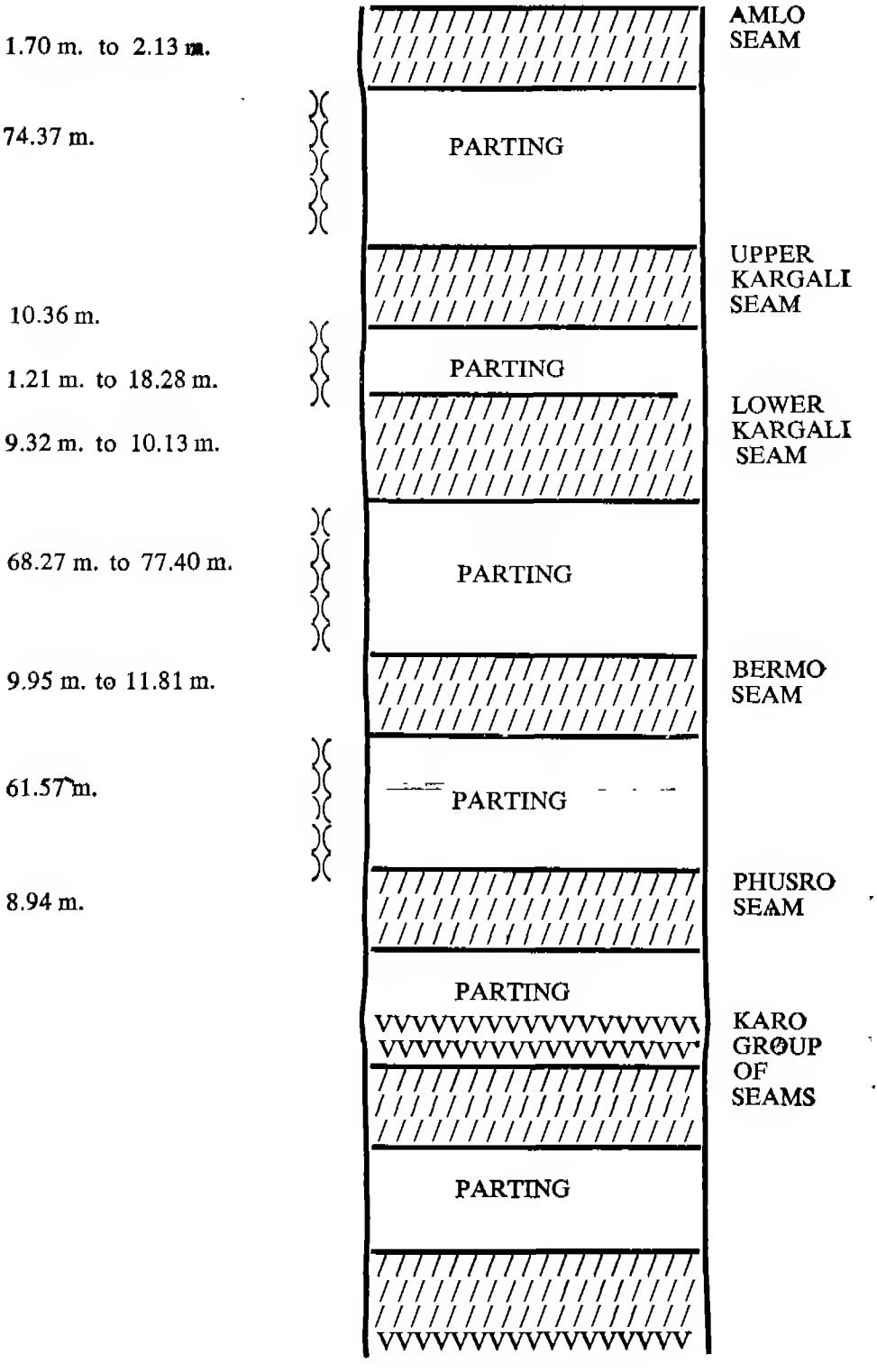
Amlo Seam.	..	1.70 to 2.13 m.
Upper Kargali seam.	..	10.36 m.
Lower Kargali seam.	..	9.32 to 10.13 m.
Bermo seam.	..	9.95 to 11.81 m.
Karo group of seams, including Phusro seam.	..	..

16. Faults and dykes of dolerite and mica peridotite are common as in other Damodar Valley coalfields. In the Dhori Colliery two dykes, one 1.5 m. (5 ft.) thick and the other 0.6 m. (2 ft.) thick running approximately in east/west direction, have been encountered in BI. 10 Incline between 4th and 5th and between 10th and 11th levels respectively. A major fault known as the Dhori-Pichri fault with a varying throw of 80 m. to 230 m. runs in an east/west direction. It divides the property almost into two parts and no seams have been worked on the south or down-throw side of the fault.

17. The Bermo seam has a thickness of 9.95 m. to 11.81 m. at Dhori. The seam is interbedded with a number of thin shale and dirt bands. Much of the coal is hard like the Jharia coal and has a banded appearance.

18. The Dhori colliery consists of a number of seams such as Amlo seam, Kargali seam in two sections (upper Kargali and lower Kargali), Bermo seam, the Karo group of seams including Phusro seam. The following section shows the thickness of the seams and the parting between them.

NOT TO SCALE


1.70 m. to 2.13 m.
AMLO SEAM
74.37 m.
PARTING
UPPER KARGALI SEAM
10.36 m.
1.21 m. to 18.28 m.
PARTING
LOWER KARGALI SEAM
9.32 m. to 10.13 m.
68.27 m. to 77.40 m.
PARTING
9.95 m. to 11.81 m.
BERMO SEAM
61.57 m.
PARTING
PHUSRO SEAM
8.94 m.
PARTING
KARO GROUP OF SEAMS
PARTING

19. We are primarily concerned in the present enquiry with the Bermo seam which only was being worked underground at the time when the accident took place. This seam has been quarried for some distance near the outcrop on the southern and north-western sides. The remaining portion of the seam extending over a strike of about 1830 m. (6000 ft.) and having an area of 114 hectares (859 bighas), has been developed by the Board and Pillar system from three sets of inclines, namely, BI. 10A (the letters B & I denote Bermo Incline), BI.10 Incline, and Amlo (Extension) Incline. In the present workings, pillars are on 21·3 m. (70 ft.) centres with galleries generally restricted to 3·0 m. (10 ft.) wide and 3·0 m. (10 ft.) high, although in some of the old workings the width and height are more than 10 feet.

20. Initially work commenced in the Bermo seam in 1920. It appears that this seam was not being worked regularly and it is on record that work was discontinued in 1942 after developing four levels. Underground work in BI.10A Incline area was re-commenced in 1944 and was discontinued on 30th April, 1948 due to excessive coal stock. By then the main dip had gone just below no. 11 level. Regular underground work in this area was again commenced in 1962. However, quarrying was being done between 1958—1963. BI.10 Incline and Amlo Incline were opened between 1956 and 1958. Some quarrying was also done in Amlo area.

21. The whole mine is developed by pick mining except in a small area of the *main dip of* BI.10A *Incline where coal-cutting machines* were used. The seam has been developed mostly in the middle horizon leaving 1·5½ to 2·2 m. (5 to 7¼ ft.) coal in the floor and 5·18 m. (17 ft.) coal in the roof. The first set of workings (southern part) is served by BI.10A incline and a second outlet. There is also another incline 173 m. (570 ft.) to the north of the travelling incline, but this was not used at the time. A separate travelling road from the surface, approximately 45 m. (150 ft.) to the north and running parallel to the haulage road, was also provided. A direct haulage worked by a 50 H.P. electric motor located on the surface, served these workings. The present development work was being done between nos. 13 and 17 levels. Over and above the main dip in BI.10A incline there were two haulage cross-cuts, which helped to carry the tubs as close to the working faces as possible.

22. The second set of workings was served by BI.10 haulage incilne, a second outlet, and also an incline 317 m. (1040 ft.) to the north of the haulage incline and a tramming level on the south-west side and a travelling road near the tramming level. Through the tramming level loaded coal tubs were brought out and empty tubs were supplied. This level was nearest to the depot. A direct haulage operated by a 30 cms. × 60 cms. (12″×24″) steam engine was installed on the surface of BI.10 incline to take out the loaded tubs and supply empties to the workings of this incline. The dip direction is 73° west; it changes, however, on the southern side.

23. There were two working panels in BI.10 incline namely, the cross-cut panel and the main dip panel (or 4 dip panel). The workings of the main dip (or 4 dip) panel lay below no. 12 level and between nos. 8 and 12 dips and the main dip. These were served by the main dip haulage road with the haulage engine on the surface at no. 10 incline. The workings of the cross-cut panel were confined to nos. 18 and 20 levels and nos. 15 and 29 dips. They were served by the same surface haulage and a 50 H.P. direct electrical haulage installed underground in no. 13 level.

24. In the third set of workings known as the Amlo (Extension) incline the workings had reached no. 23 level. They were confined to between 10 west dip and 10 east dip. These workings were served by direct steam haulage engine 30 cms. ×60 cms. (12″×24″) installed on the surface. The direction of dip of the seam in the Amlo incline is south 82° west.

25. All the three sets of workings were connected with one another by underground galleries. There was one connection in no. 4 level between the workings of BI.10A and BI.10 inclines, and there were two connections between the workings of BI.10 incline and Amlo (Extension) incline in no. 13 and no. 14 levels. The workings of BI.10A incline had extended to a distance of about 365 m. (1200 ft.) from the incline openings. The depth of cover at the dip-most point is about 70 m. (230 ft.).

26. The accompanying plan shows at a glance the workings in the three inclines *viz.*, BI.10A BI.10 and Amlo (Extension) inclines (see Plate I).

27. From the Report prepared by N.D. Mitra and A. K. Dey, Geologists of the Geological Survey of India, at the instance of the Court, it appears that immediately south of the workings of the Bermo seam, there is a big fault known as the Gobindapur-Pichri fault (see Plate II). This fault is represented by a well defined crushed zone. The earlier prospecting work by A. B. Dutt revealed that in an incline driven south of that fault in the Dhori colliery area, a crushed zone was encountered in the Gobindapur-Pichri fault alignment and due to the faulted and highly slickensided rocks the incline was abandoned. This crushed zone is exposed on either side of the Barkakana loop railway line near Dhori colliery and can be traced further east near the bridge on the Damodar river. On the eastern bank of the Damodar river, the crushed zone is very well exposed and has a width of about 100.5 m. (330 ft.). Further west, south of the workings of the Dhori colliery, it maintains more or less the same width. In the crushed zone, a number of shear fractures, slip planes and small faults are developed. The Geologists' report further shows that the Gobindapur-Pichri fault zone has produced major structural disturbances in the area. The northern upthrown area is, however, relatively free from faulting, where active mining operations are carried out. Minor faults have however, been noticed near some incline mouths of the Bermo seam. But the southern downthrown side of the Gobindapur-Pichri fault is tructurally most disturbed. The fault has a downthrow of about 91·4 m. to 152·4 m. (300 to 500 ft.). In BI. 10A incline the coal seam upto the 14th level was free from major disturbances, but small scale slips and fractures were noticed by the Geologists at places in the 14th level, specially near the first pillar of the south gallery. The Geologists examined the Bermo seam only upto the 14th level, the dip galleries and levels beyond the 14th level being water-logged at the time when the Geologists made their examination. The Geologists further found that the workings of the southern galleries of the 15 and 16 levels of BI. 10A incline as shown on the plan were driven within a distance of about 45·7 m. (150 ft.) from the Gobindapur-Pichri fault zone. They further found that Gobindapur-Pichri fault had brought the upper Karagali seam of the southern downthrown block almost in juxtaposition with the Bermo seam of the northern area. Upper Kargali is known to be a gassy seam. Due to the fault, the upper Kargali seam on the down-thrown side lies within 6-10 m. below the projected position of the Bermo seam on the northern side of the fault.

The accident and what was found thereafter:

28. We shall now state the facts found as a result of the accident and soon thereafter, by Officers of the Chief Inspector of Mines and other persons who saw the colliery, surface as well as underground, soon after the accident. At the time of the accident, the Manager of the Colliery, P. N. Chowdhary was away on leave. The senior-most Assistant Manager, A. K. Singh, was incharge at the time. The evidence of the Manager is that the entire body of workers in the mine went on strike on April 6, 1965, excepting some persons employed in the electrical and mechanical sections and the monthly paid staff. The strike came to an end on May 21, 1965, and on May 23, 1965 P. N. Chowdhary went on leave. He came back on the night of the 30th, i.e., some two days after the accident.

29. The evidence led before us shows that on the night of the accident three successive loud reports were heard and flames about 150 ft. high were seen emerging from the Amlo incline. A very wide area was seen covered with a thick layer of coal-dust around BI. 10A, BI.10 and Amlo inclines of the colliery. K. S. R. Chari, Area General Manager of the National Coal Development Corporation, who was examined as a Court witness, said that the sheets on the beds kept on the verandah of his bungalow, on which his children were sleeping, were all covered with coal dust and so also the rose plants in his garden. The bungalow of Chari is situated at a distance of about a kilometre from the three inclines. At the time of the explosion one of the coal-cutting machines was stabled in the haulage dip of BI. 10A incline below 16 south level and the other was lying in the 17 south level off the new cross-cut, disconnected from the source of supply of electricity. From the position of the machines it is evident that none of them was in operation at the time. Naked lights (Hurricane lanterns) were used in the mine for the purpose of illumination. Upto the time of the explosion, the mine was treated as non-gassy. There was no mechanical ventilator, the air being circulated by natural ventilation only. Some stoppings were constructed in the mine to course the air; but no record of quantity of air passing at any point at any time had been kept, and actually no air measurement had ever been taken.

30. Information of the accident which appeared to be of the nature of a series of explosions was conveyed by A. K. Singh soon after 1.30 A.M. to various authorities, including the Chief Inspector of Mines and the Superintendent of the

Mines Rescue Station, at Dhansar, Dhandbad. The Officers of the Chief Inspector of Mines, including the Chief Inspector himself, arrived at the colliery at about 4.40 A.M. The rescue teams also arrived at about the same time. Rescue operations were commenced immediately and under orders of the Chief Inspector of Mines all plans, registers and relevant documents relating to the colliery were seized by an officer of the Inspectorate.

31. The report of R. G. Deo, Additional Chief Inspector of Mines, gives some details of the damage noticed at the time by the officers of the Inspectorate. Deo says: "At BI. 10A incline we noticed the following damages: (1) the south wall of the attendance room had been partially damaged; (2) the top of the engine house of the surface electric haulage had been blown up; (3) the attendance clerk was thrown over a distance of about 12 m. (40 ft.) from the attendance room and was killed, and his body had still not been removed; (4) the 4.5 m. (15 ft.) long electric pole in front of the incline was completely bent at the base; some big boulders of coal were lying on the track in front of the incline; (6) the track had been shifted from its original alignment and the rails were twisted and buckled; (7) coal dust was seen spread over the whole area. Near BI. 10 tramming level we saw a new opening on the south side and some fallen debris, evidently a result of the explosion. Smoke was coming out of this new opening which was connected with BI. 10A incline workings. Two dead bodies were seen outside the entrance of the travelling road and the tramming level. The surface haulage room was badly damaged. One wall had collapsed and the roof had been blown off over a distance of about 60 metres. We then went to the Amlo (Extension) incline where the damage appeared to be the maximum. A huge quantity of debris had been collected in front of the incline. By a rough estimate this quantity was about 8,000 tonnes. The surface haulage engine room was affected. The mouth of the incline had collapsed and a coal tub was seen dangling in front of it. Smoke was issuing out from the openings on the east side. At once of these openings I took a reading with a carbon-monoxide detector and it showed 0.1% carbon-monoxide. The officiating manager told us that two stones [one weighing 140 kgs. (3.8 maunds) and the other weighing 138 kgs. (3.4 maunds)] were hurled over a distance of 275 metres (900 ft.) like missiles and one of them had killed a person who was sleeping on a cot in his courtyard in Amlo village."

32. A fuller survey of the damage done, both at the surface and underground, was made by H. R. Mukherjee, Chief Surveyor, who prepared several plans showing the damage done. These are part of the evidence in the case and will be referred to in subsequent paragraphs of the Report.

33. Some members of the Rescue teams, it appears, took samples of air and also tested the mine atmosphere for gas and carbon-monoxide. Unfortunately, on the evidence led before us, the exact places from where air samples were taken by the members of the Rescue teams cannot be definitely fixed. The samples were sent for analysis to the Central Mining Research Station at Dhanbad and the analysis showed neither the presence of carbon-monoxide (CO) nor methane gas (CH_4).

34. It appears that for the first few days the officers of the Inspectorate thought that the explosion might be due to a blown-out shot. Necessary steps were, therefore, taken to de-water the dip galleries of BI. 10A incline for any indications of shot-firing.

35. On June 4, 1965 the officers of the Inspectorate along with the Manager and Assistant Manager of the colliery examined No. 15 south level of BI. 10A incline. They noticed a haze near the roof of the level and suspected that there might be gas near the roof. It was then decided to check for the presence of firedamp in this gallery ,by a Riken Interferometer, M.S.A. Methanometer and a flame safety lamp. Deo's report states: "The percentages of gas obtained in the gallery were as follows:—

	Riken Interferometer	M.S.A. Methanometer	Flame Safety Lamp
1	2	3	4
	%	%	%
1. About 10·5 m. inbye of the junction of south companion dip, 15 south level	2·6	2·6	2·5
2. About 45m. inbye of the junction of south companion dip, 15 south level, wherefrom dead body had been removed	4·6	4·6	4·0

1	2	3	4
3. About 60 m. inbye of the junction of south companion dip, 15 south level, above the lantern	% 4·2	% 4·4	% 4·0
4. About 85 m. inbye of the junction of south companion dip, 15 south level, at the face	3·8	3·6	3·5

"The readings taken by Methanometer and Riken Interferometer were seen by the Manager and Assistant Manager R. P. Singh. They were satisfied that firedamp, as mentioned above, was present in the gallery. They confirmed these observations in their written statements."

36. These samples were sent to the Central Fuel Research Institute, Digwadih, for analysis. Unfortunately, the sampling bottles developed leaks as they were not properly sealed, and the Central Fuel Research Institute reported that the air samples were not analysed for combustible gases, because the sampling tubes were not greased. The evidence of S. Gupta shows, however, that one sample from the samples taken on June 4, 1965 was subsequently analysed and was found to contain (CH_4) to the extent of 3.34.

37. On June 8, 1965 further air samples were taken from 15 south level. The results are shown in the tabular statement given below:—

Sl. No.	Particulars of sample	Analysis Result					
		% CO_2	% O_2	% CO	% H_2	% CH_4	% N_2 (By difference)
1.	Sample marked (1), about 10·5 m. from pump 1¹ below roof level . . .	1·44	19·19	nil	0·60	4·09	74·66
2.	Sample marked (2), O.B. 1¹, 4·2 (i.e., 0·3 m. below roof level at the place wherefrom dead body had been removed . .	0·93	19·60	0·14	0·04	4·76	75·13
3.	Sample marked (3), 4/4·5 R Lamp 1¹ (i.e. 0·3 m. below the roof level at the lantern	1·34	20·55	..	..	3·95	74·16
4.	Sample marked 1A, 4·5 east corner about 10·5m. from pump .	1·25	18·70	..	..	4·00	76·05
5.	Sample marked 5 RL, east corner, pump, 2·6 . . . (This sample was collected near the roof level on the east side of gallery close to the pump.)	0·44	19·17	..	0·19	2·37	77·13

A sample [marked (4)END., 1¹, 3·4/4] had been collected at the face of 15 south level gallery also, but the sample could not be analysed in the laboratory as the sampling tube broke while attempting to open the stopper.

38. These samples analysed by the Central Fuel Research Institute contained CH4 as given below:—

Particulars of sample.	CH_4
1. Sample marked (1), About 35¹ from Pump, 1¹ below roof level (No date of collection given)	4·09
2. Sample marked (2), O.B. 1¹, 4·2 (No date of collection given)	4·76
3. Sample marked (3), 4/4·5 R lamp 1' (No date of collection given)	3·95
4. Sample marked A, 4 5 east corner, 25' from pump. (No date of collection given)	4·00
5. Sample marked 5 RL east corner, pump (illegible writing) 2·6	2·37
6. Sample marked (4) end, 1¹, 3·4/4	Due to scanty or no grease in the stoppers while attempting to open one, it jammed and the tube broke.

39. According to the Rescue Log Book, a dead body was located in the 15 south level on May 30, 1965. There were two lanterns—one damaged and the other undamaged. The damaged lantern was near the pump and the undamaged lantern was about 39 ft. from the dead body.

40. During the inspection of 15 and 16 south levels by the Court of Enquiry and the Assessors, further air samples were taken from five places. These samples were also sent to the Central Fuel Research Institute for analysis and the tabular statement given below shows the results:—

Sl. No.	Details of sample	CO_2 %	O_2 %	CO %	H_2 %	CH_4 %	M_2 (By diff.) %
1.	(1) About 35¹ from pump collected on 26-6-65	1·64	16·90	Nil	0·07	11·23	70·16
2.	(2) 15 SL face collected on 26-6-65	1·24	14·09	0·17	0·31	9·50	74·69
3.	(3) Face, collected on 26-6-65	1·25	17·48	0·42	Nil	9·82	71·03
4.	(4) 16 SL face collected on 26-6-65	0·44	19·72	0·09	0·03	0·97	78·75
5.	(5) Rise off 16 SL collected on 26-6-65	0·34	19·87	0·07	Nil.	0·78	78·94

41. H. S. Ahuja, Regional Inspector of Mines, and H. K. Roy, Inspector of Mines, took dust samples from the surface and well as underground working in all the three inclines. All told 412 dust samples were taken and they were sent to the Central Fuel Research Institute for analysis. A plan was prepared showing the places from where dust samples were taken, and this plan is part of the evidene in the case. The analysis showed that the percentage of incombustible matter in the dust samples was less than what was required as a precaution against liberation and accumulation of coal dust as per Regulation 123 (5)(b) of the Coal Mines Regulations, 1957.

Causes of the accident: Two rival theories:

42. From the Statements of the Cases filed before the Court of Enquiry, it appears that two rival theories have been placed before the Court of Enquiry by the parties. The theory put forward by the Department of Mines is contained

in their Statement of the Case which recites as follows: "From the data available it appears that in 15 south level of BI. 10A incline of Bermo seam there was an accumulation of fire-damp within explosive limits. It was ignited by the hurricane lantern of a person who entered this gallery. As a result of this ignition a fire-damp explosion was caused. As there was enough fuel in the form of coal dust in all parts of the mine, a coal-dust explosion was initiated by the gas explosion which soon propagated to all the other parts of the mine, namely, the workings of BI. 10A, BI. 10 and Amlo (Extension) inclines." According to this theory, there was an accumulation of fire-damp upto the explosive limit in blind gallery No. 15 south level of BI 10A incline, which gallery was driven over a distance of about 88 m. (288 ft.) from the junction of south companion dip and 15 south level; as a hurricane lantern was found and a dead body was also recovered from the gallery, the natural conclusion to be drawn (as stated by the Department of Mines) is that ignition started in this gallery when the open light came into contact with the explosive mixture of methane gas. According to the case put forward by the Department, this gallery was not being developed after the termination of the strike, and no pick nor any basket were found in the gallery.

43. There was enough coal dust present in the gallery to initiate a coal dust explosion, and as is well-known, coal-dust explosions are started most readily by an explosion of methane. The initial shock wave from an explosion of a body of fire damp, travelled through the air in all directions, and was instrumental in stirring up coal dust in the vicinity of the origin of the explosion, and owing to the momentary lag while the initiatory combustion of coal dust is building up pressure by the hot gaseous products, the shock wave got ahead of the explosion. The advance air waves which made the propagation of coal-dust explosion possible by sweeping the dust from floors and walls and mixing it to make a dense cloud were those developed immediately ahead of the explosion flame and were due to the pressure of the expanding explosion gases. Thus, a series of explosions were propagated, which travelled from BI. 10A to BI. 10 and then to the Amlo (Extension) incline, thereby causing great damage to BI. 10A incline, greater damage to BI. 10 incline and the greatest damage to Amlo (Extension) incline. According to this theory, the direction of the blast was from south to north, *i.e.*, from BI. 10A to BI. 10 and from BI. 10 to the Amlo (Extension) incline. This theory has been supported by the Department of Mines, the State of Bihar, the Indian National Trade Union Congress and the Colliery Mazdoor Sangh, the Hind Mazdoor Sabha and the Indian Mine Workers' Federation.

44. The Management has, however, repudiated the above theory and has given its own theory as to the cause of the accident. According to the Management, the explosion was the result of an act or acts of sabotage. In support of its theory the Management examined an expert, R. P. Sinha, Head of the Department of Mining, Jodhpur University since October 1, 1965. He inspected the various inclines on several dates in August, 1965 and came to certain conclusions. These conclusions were set forth in an affidavit which was later supported by his evidence. His conclusions are: (1) that there was no gas in the mine prior to the explosion; (2) that the seat of ignition was in the blind dip gallery in the 9th level east in Amlo incline; (3) that the explosion in the aforesaid gallery was due to a coal fire intentionally ignited by human agency which coming into contact with some kind of explosive substance or material such as gun powder and/or gelatine placed in a container was the seat of explosion; and (4) that the force of the blast travelled from Amlo incline to BI. 10 and then to BI. 10A.

45. We have mentioned the two theories which have been placed before us. We must make it clear, however, that our enquiry is not restricted to the two theories stated above. An explosion cannot occur unless we have at the same time and place a source of ignition and a medium capable of explosive combustion such as gas or coal-dust in air. The explosive combustion may be initiated by a wide variety of causes, and, once initiated, continues as long as the medium remains inflammable.

46. In an enquiry into an explosion like the one at Dhori colliery, in order to find out the possible or the probable causes of the explosion and to find out the place of ignition from which explosion could have started, it is necessary to consider the following points separately and to try and collect answers to each of these points.

1. Was it purely a gas explosion or did coal dust play any part in it?

2. Can the place of origin of the explosion be ascertained with a reasonable certainty?

3. Can the source of ignition be fixed with reasonable certainty?

4. Do the underground indications show the direction in which the explosion has travelled?

5. What part did one or more of the following play in the origin and the propagation of the explosion—

(i) good or bad ventilation;

(ii) method of working the mine;

(iii) supervision in the mine;

(iv) geological features in the mine;

(v) presence of coal dust in the mine;

(vi) natural wetness or dryness of the mine workings?

47. From the observations of the mine conditions within a few days of the explosion, by the Chief Inspector of Mines and his officers, and from the inspections made by the Court on June 26 and June 27, 1965, it is clear that coal dust had played a very important part in the explosion.

48. As a result of the inspection by the Court and the subsequent inspection of all the electrical apparatus by the Electrical Inspector of Mines, the following sources of direct ignition of coal dust have been eliminated: (i) short firing—blown out shot; (ii) electrical sparking in one of the electrical equipments or in a power cable; and (iii) very intense spark due to some metal coming in contact with another metal or with stone.

49. That would leave the following two sources of ignition as the probable causes of starting the coal dust explosion: (i) ignition of fire-damp (CH4), a fire-damp explosion resulting in coal dust explosion; and (ii) a very hot flame from a fire shooting into a cloud of coal dust.

50. After the explosion, when the mine was inspected by the Chief Inspector of Mines and his officers, the following significant facts were noticed: (i) presence of CH_4 (over 4 per cent) was noticed in no. 15 south level of BI.10A incline; (ii) presence of CH_4 (about 2 per cent) was noticed in No. 16 south level of BI.10A incline; and (iii) a very intense fire was located in the 2nd dip of No. 9 east level of Amlo incline. A number of other signs of small fires as a result of the explosion were also noticed throughout the mine.

51. Since CH_4 was discovered in the south side of the colliery workings and a very intense fire was seen in the north side of the colliery, both after the explosion, a number of factors will have to be studied to eliminate one or the other source of igniting the coal dust and starting a coal dust explosion. If nothing can be said with certainty even after studying these various factors, at least it will be possible to say as to which one was the more probable source of starting the explosion.

52. We have, therefore, to study properly the observations that have been made and investigations that have been carried out to see whether these would help us to come to some conclusion about the most probable place of the origin of the explosion and also the most probable source of ignition that started the trouble.

53. In the 15 south level of BI.10A incline, an undamaged hurricane lantern was found. A dead body was also found within a few yards towards the north side of this hurricane lantern. The nature of the damage done to the machineries lying within a distance of a couple of hundred feet of this lamp and also the machineries in the main haulage dip of BI.10A was very minor. Since gas was found in this gallery in almost an explosive mixture on the 4th of June, 1965 *i.e.* on the 8th day after the explosion and since no signs of an outburst of gas were noticed in this gallery during the days of inspection by the Chief Inspector of Mines, and later on by the Court, it would be reasonable to suppose that gas (CH_4) was leaking in this gallery from the coal sides and the coal roof in very small quantities and was collecting in this gallery due to very poor, almost no, circulation of the air in this gallery. This gallery had advanced blind for a distance of about 288 ft. from the last ventilation connection. This gallery was also found to be in a very dry condition, both on June 4, 1965 when it was first inspected by the Chief Inspector of Mines after the explosion and also on June 26, 1965 when inspected by the Court. When this gallery was inspected on June 26, 1965 by the Court, the percentage of (CH_4) was found to be over 10 per cent. It may also be mentioned that the gallery just below 15th

South level, *viz.* 16th south level, also showed 2 per cent of CH when inspected on June 26, 1965, even though this 16th south level of BI.10A incline was naturally very wet, with water percolating from thereof and the sides. In order to find out how many days it would take for this very small leakage of CH4 in No. 15 south level of BI.10A incline to build up to a percentage of 5 and over, the Court arranged with the assistance of the Chief Inspector of Mines to first clear all the CH_4 from the 15th and 16th south levels by means of a fan and then allowing the natural ventilation to take over once again. After that, daily readings of CH_4 percentage in the atmosphere in 15 south level of BI.10A were taken and these showed that the gas (CH_4) was steadily building up and it went upto about 2 per cent. At this stage, however, the rains started and with the drop in temperature, the natural ventilation in the mine improved and gradually the percentage of CH_4 in the atmosphere in 15th south level went down till it almost came to nil. The gradual reduction of CH_4 percentage in the above gallery might also be due to the fact that the source of gas in the neighbouring strata was exhausted by that time.

54. As for the intense fire, which was discovered in the 9th east level, 2nd dip, of Amlo incline, we will have to study the circumstantial evidence to establish whether this fire took place before the explosion or it was a result of the explosion. During the original inspections, both by the Inspectors of Mines and also by the Court, no indications were noticed nor any suggestion was made that this fire could have started, either on its own or through some outside agency, before the explosion and could have been the probable cause of this disastrous accident. As almost all the explosions start underground fires, either minor or major in nature, this fire, along with the other small fires noticed underground, was considered to have started as a result of the explosion.

55. Since, however, the Management, at a late stage in the enquiry, has put forward a suggestion that this fire was actually the seat of explosion and that the fire was man-made, this theory must be carefully examined and reasonably correct answers must be found to various questions so that it could either be accepted or eliminated as the source of ignition which started the explosion. If this place is to be accepted as the probable seat of explosion, then the underground indications, which would give us an idea of the general direction in which the waves of explosion might have travelled, must also fit in reasonably well. It is accepted that an explosion like the one in Dhori does not take only one straight line of travel, but spreads out everywhere where fuel in the form of fine coal dust is available. But in all explosions, it is possible to trace the general direction of propagation of the flame and establish the path and spread of the explosion, from the post-explosion observations underground.

56. Major indications, which have been observed underground after the explosion, and which might give some idea of the direction in which the explosion waves had travelled are: (i) positions of the heavy machinery after the explosion and the type of damage done to them; (ii) the direction in which the steel rails, angles, etc. fixed in the sides of the pillars and used for signal wire supports have been bent; (iii) the way the underground haulage tracks have been twisted; (iv) the positions in which the broken pieces of wooden roof bars are found after the explosion; and (v) intensity of the damage done to the machineries and also to other installations in the different parts of the mine.

57. Most of the machineries underground, which were noticed after the explosion, have been thrown towards the north of their original positions. The post explosion positions of the machines in BI.10A incline have only slightly changed towards the north of their original positions. As we go towards the BI.10 and then towards Amlo incline, from south to north, it is observed that both the damages done to the machines as well as the distance through which these machines have been shifted gradually increase. The underground electrical haulage situated in BI.10 incline workings has not only suffered the maximum damage to its different parts but a number of parts of the haulage, after being broken, have been thrown a considerable distance towards the north of the haulage. A body was also found in the gallery which is on the north side of the haulage room. It can be presumed that this body was that of the haulage khalasi and that he must have been in the haulage room at the time of the explosion. The violence of explosion in this part of the mine must have been of a tremendous degree. Not only the steel and the cast iron parts of the haulage have been broken but these, along with the electrical motor and the switch gear, have been bodily lifted from their original positions and thrown a considerable distance in the gallery towards the north side.

58. From the indications, it can be assumed that the explosion waves, while travelling from one incline workings to another underground, had also tried to

escape towards the surface through every available opening. It was observed from the inspections that while trying to escape through these openings, the explosion waves had caused a certain amount of damage to the mouths of the inclines as well as to the machineries and the buildings on the surface near these inclines. The nature of damage on the surface could also give us some indication as to the intensity of violence with which the explosion waves came out from different inclines. The surface indications show that the maximum damage is in the Amlo incline area. This would also be some indication that the explosion started somewhere in the south of the mine and travelled towards the north and the final waves that came out of the Amlo incline caused a lot more of damage.

59. Now, let us examine the other theory put forward by the Management that the seat of the explosion was the fire in the 9th east level, 2nd dip, of the Amlo incline and that the explosion waves travelled from north towards the south. This place, 9th east level, 2nd dip, is not very far from the Amlo incline haulage road and the explosion waves, if the explosion had started at this place, would have travelled towards the haulage road, i.e. from south to north, and would have found a quick escape up the incline. Since the haulage road was noticed to have sufficient coal dust after the explosion, a part of the explosion waves would have travelled down along the haulage road and gone down to the workings. Of course, from the seat of the ignition itself, another wave would have travelled towards the south and found its way down to the other mine workings picking up the fuel in the form of coal dust as it went along. The explosion wave, however, that would have gone towards the haulage road and then split up and down, would have bent all the signal wire brackets in the direction in which the wave travelled. Thus, the signal wire brackets from No. 9 level uphill would have been bent towards the rise and the signal wire brackets from No. 9 level downhill would have been bent towards the dip of the seams. This is not what we see in the mine and even the Manager, in his evidence, has stated that in Amlo incline main haulage road, all the signal wire brackets were bent towards the rise.

60. As the general travel of the wave of the explosion, if it had started in No. 9 east level of the Amlo incline, would have been from the north to the south, this would have resulted in all the underground machines lying towards the south side of their original positions. This is not so, as the machines have been seen to have shifted towards the north of their original positions. The Management has supplied, along with their Statement for supporting the theory, a plan of the three inclines. On this plan, the Management's expert has shown a number of arrows which, according to him, show the direction of the explosion waves as ascertained from various indications he has noticed underground. He has not mentioned in his report what were these indications that made him to decide the exact direction of the explosion waves, and even if his statement is accepted at its face value and all his arrows are accepted as indicating the direction of the travel of the explosion wave, it is noticed that a number of these arrows meet in a common point from where no escape route for the explosion wave is available nor has it been shown on the plan. Even if we suppose that the fire in No. 9 east level, 2nd dip, gallery of the Amlo incline was man-made and started before the explosion, it is difficult to imagine an underground fire of this kind starting on its own a major coal dust explosion. To start a coal dust explosion, there must have been some sort of initiatory explosion or some suitable physical phenomenon to raise coal-dust in air and also a source of ignition to ignite the coal-dust/air mixture. The Management's original suggestion was that the fire had been started with a view to sabotage. But when this particular question was raised in the cross-examination of the Manager, he suggested that such an initiatory explosion might have been caused due to some explosive hidden inside the heap of coal which was set on fire or it might have been caused by petrol kept within easy reach of the fire. An act of sabotage to cause loss to the management by damaging the mine by starting a fire and putting the mine out of commission for a long time is one thing; but an act of sabotage with a definite intention to start a coal dust explosion, when nearly 300 men would be in the mine, is entirely another. Actually, the second act would not be a sabotage, but would amount to an act of mass murder.

61. There are other very good reasons why the theory propounded by R. P. Sinha and adopted by the Management as its case, cannot be accepted as correct. The theory has undergone development from time to time. In the first report of R. P. Sinha submitted on August 1, 1965, he said that on "both sides of the 9th level, 2nd east dip, of the Amlo incline, there were pieces of charred wood and the coal was heavily coked in big "lumps which gave the appearance as if the fire was set by means of wood on both sides of the dip gallery and big lumps of coal were put over it with a view to create a blazing fire such as people do when they want to prepare soft coke from lumps of raw coal." In his last report

dated September 1, 1965, he said: "I saw big chunks of coke and a huge heap of coal about 1 or 2 tons on the sides. This heap of coal caused a suspicion in my mind that the fire could not possibly be directly connected as a result of the fire of explosion wave. I started out to find out what was the depth of the burning and found some pieces of wood which were half-charred and appeared as if they were placed there with a view to set the coal heap on fire." It is worthy of note that there was no mention of a heap of coal in the report submitted on August 1, 1965. It was for the first time on September 1, 1965 that R. P. Sinha mentioned about "the heap of coal". It is to be noted further in this connection that an intense fire was raging in this gallery at the time when the Rescue teams were busy in rescue operations. The evidence on record shows that special steps were taken to put out this fire and the fire was put out after about 56 hours, *i.e.*, at about 9 A.M. on May 30, 1965. We find it extremely difficult to believe that "a heap of coal and pieces of half-charred wood" would be found at the place after the raging of an intense fire for about 56 hours. It is still more surprising to note that what was a heap of coal first became "freshly out" coal at a later stage of the evidence. It is exceeding strange that signs of "freshly cut" coal would remain after an intense fire raging for 56 hours and that these signs would be noticed by nobody before the appearance of R. P. Sinha on the scene. When the Assessors inspected the gallery on June 27, 1965, they noted the condition of the gallery as follows: "When we reached higher up, the Chief Inspector of Mines showed us the dip blind gallery where the most severe fire had occurred after the explosion. From the condition of the roof and sides we could see that the fire must have been very intense." It is strange indeed that after an intense fire which had raged for about 56 hours, signs of freshly cut coal were still found by R P. Sinha.

62. The evidence of P. N. Chowdhary, Manager of the Mine, is by itself sufficient to demolish the theory put forward by R. P. Sinha. The Manager was present when the Assessors visited the gallery in question on June 27, 1965. He also accompanied R. P. Sinha when the latter made his inspections in August 1965. The Manager as well as R. P. Sinha talked of some broken pieces of earthen pot, and an earthen pot kept in a hole near the roof of the gallery. These were not mentioned in the first report submitted on August 1, 1965. Apparently, the suggestion was that some explosive substance might have been kept in an earthen pot. The Manager was asked whether he showed to the Assessors any of the things which he later mentioned as having been found by him and R. P. Sinha in the 9th level, 2nd east dip, of the Amlo incline. His answer was, "NO". Then, the following question was asked of the Manager by the Court:

> "Q. Mr. Chaudhury, does not it sound astounding that there were these broken pieces of earthen pot and there was a heap of coke and you did not show these things to Assessors?
>
> "A. On that day I did not see them in that gallery."

63. If the things (which R. P. Sinha and the witnesses examined on behalf of the Management say were found in that particular gallery) were not seen there when the Assessors visited the gallery, the only obvious inference is that they were not there on the date on which the Assessors visited the gallery, but were placed there some time later. It is to be remembered here that the mine was under control of the Chief Inspector of Mines till July 8, 1965 and thereafter it was released in favour of the owner R. P. Sinha's visits underground took place in August, 1965.

64. Another surprising feature about the theory of R. P. Sinha is this. He was asked if he could give any opinion as to how the ignition took place in 9th level, 2nd east dip, of the Amlo incline. "He gave the following answer:

> "Yes, I think the coal was ignited, but I cannot say how it was ignited; probably by wooden fire because I saw charred pieces of wood under the coal. I did not see any container there, but it is probable that some two or three feet away from the heap of coal some explosive might have been put in a container with a detonator."

He was then asked by the Court whether detonation would generate a lot of force and objects at the seat of detonation would be scattered. To this question he gave an affirmative answer. If actually the heap of coal in the 9th level, 2nd east dip, of the Amlo incline had been first ignited by means of a wood fire and then a blast generated by detonating some explosive substance, it would be strange indeed to find the heap of coal still remaining in the same condition as a man-made heap of coal! The coal would undoubtedly scatter by the blast of the explosion. Furthermore, smoke would come out when the wood fire was lighted and the smoke would travel either towards the haulage dip or towards the dip workings so that miners working in the incline would at once know that

there was a fire in the mine from which smoke was coming. In our opinion, the theory propounded by R. P. Sinha is so inherently improbable that it cannot be accepted as correct.

65. R. P. Sinha has undoubtedly high academic qualifications. He also has had a fair amount of experience, and held high posts both under the Union Government and the Government of the State of Bihar. The theory of an expert, howsoever eminent he may be, must, however, be judged on merits with reference to the evidence given in the case. R. P. Sinha gave some reasons why he could not be present at the time when the Court of Enquiry inspected the three inclines in question. It is unnecessary for us to examine the correctness of those reasons. Even if it be assumed that he had good reasons to be absent when the Court of Enquiry inspected the colliery, his evidence as to the seat of ignition is demolished by the evidence of the Manager; his theory has inherent improbabilities and there is affirmative evidence on record to show that what he says was found in the 9th level, 2nd east dip, of the Amlo incline was not there at all soon after the explosion. On the evidence given before us his theory breaks down completely. We may here point out that his opinion that there was no gas in the mine prior to the explosion is not based on any observation. He could not inspect 15 south level of BI.10A incline, because it was under water at the time of his visits underground.

66. There is one point on which R. P. Sinha clearly gave misleading evidence. There was some argument before us as to why the air samples and dust samples taken on June 4, 1965 and thereafter, were not sent to the Central Mining Research Station, but were sent to the Central Fuel Research Institute, Digwadih. R. P. Sinha said in his evidence that coal dust samples and air samples are analysed and examined in the Central Mining Research Station and not at the Central Fuel Research Institute by reason of a Government circular on the subject. He was cross-examined on the point and was asked to give the number and date of the circular; he was also asked as to the authority to which the circular was addressed. R. P. Sinha was unable to answer any of these questions. Then, it was suggested to him that he was mentioning an imaginary circular which did not in fact exist. To this he said that he had not seen the circular himself but somebody had informed him about it. Who that 'somebody' was, he did not remember. Some two days after, he put in a petition stating that through inadvertence and faint recollection he had mentioned the expression 'Government Circular'. He said that on actual verification he came to know that there was a resolution passed by the Executive Committee of the Central Mining Research Station, which was subsequently approved by the Vice-President of the C.S.I.R. recommending that investigations and testing work of the Department of Mines be done free of charge by the Central Mining Research Station. Obviously, there was no interdict to the effect that dust samples and air samples should not be sent to the Central Fuel Research Institute, Digwadih. R. P. Sinha first wanted the Court to believe that there was a Government Circular imposing such an interdict and that he was speaking from his direct knowledge. He completely broke down in cross-examination, and it became apparent that he was saying things which were not within his direct knowledge. It further transpired that there was no interdict of the kind which R. P. Sinha wished to convey in his evidence.

Findings of the court as to the causes of the accident:

67. From the evidence given before us we are satisfied that there was an accumulation of fire-damp within explosive limits in 15 level south of BI.10A incline prior to the accident. This body of fire-damp was ignited by the flame of a naked light carried by a person who entered the gallery on the night of the accident. The reason why the person entered the gallery, which was not being worked at the time, cannot be definitely fixed. As a result of the ignition, a fire-damp explosion was caused and as there was enough fuel in the form of coal dust in all parts of the mine, a coal-dust explosion was initiated which soon propagated to all the other parts of the mine, namely, the workings of BI.10A, BI.10 and Amlo (Extension) inclines. The main cause of the accident was, therefore, fire-damp explosion initiating a series of coal-dust explosions, the seat of ignition being near the dead body in 15 south level of BI.10 incline.

68. There were, however, other contributory causes to which we shall presently refer in succeeding paragraphs. We shall also deal with other circumstances attending the accident. But we must dispose of here two points argued before us regarding the main cause of the accident. One of the points is that the presence of CH in 15 south level of BI. 10A incline some days after the accident does not necessarily mean that there was an accumulation of methane gas in that level prior to the accident so as to result in a fire-damp explosion by ignition. The second point argued is that no reasonable explanation has been offered

by the Department of Mines as to why after the mine had been cleared of all gas by direction of the Court of Enquiry, there was a build-up of gas for a few days only after which the percentage of gas became down to almost *nil*.

69. These two points have a bearing on the cause of accident and should be dealt with here. As to the first point, we agree that the presence of fire-damp some days after an accident does not necessarily lead to the inference that there was an accumulation of fire-damp prior to the accident. One must examine all the circumstances before drawing an inference. In a mine, gas is given off in three principal ways—(1) by gradual exudation or bleeding from the strata; (2) in the form of "blowers"; and (3) in the form of "outbursts". We found no traces of "blowers" or "outbursts" in the present case.

70. Due to the blast of an explosion especially in the localities where it is somewhat severe, the strata may get disturbed resulting in the formation of openings, such as fissures, cracks etc. If gas is present in the strata within easy reach, it may exude in the workings through such opening after an explosion. In such a case, evidence in the nature of fresh openings, fall of roof etc. would be there. No such evidence was, however, noticed in the different dip levels of BI 10A incline, where gas had been detected.

71. In view of the long drivage of these galleries, especially that of the 15th and 16th south levels, the effect of the blast in them was likely to be the minimum. Blast of the explosion must have also affected other working faces probably with more severity. In that case there would have also been emission of gas in those galleries. This is, however, not the case. Emission of gas along a particular zone, which had been affected least by the blast of the explosion is, therefore, very significant. This emission must be due to reasons other than disturbance caused by the explosion.

72. Coming to the theory of distillation of coal as a result of the explosion, referred to by some of the witnesses, it is correct that by the distillation of coal, methane gas is produced. During the explosion, a distillation process is no doubt stimulated as is evidenced by the presence of coked dust. There is, therefore, a possibility of the presence of methane gas in the workings after an explosion. If the gas detected in the dip levels of BI.10A incline is the product of such a process, similar accumulations would also have been detected in other places as well. Furthermore, the results of the tests for gas made for the period commencing June 30 and ending July 7, conclusively prove that the formation of gas is not due to distillation of coal, as after the removal of the same from the 15th and 16th south levels of BI, 10A incline, methane gas was still observed to emit.

73. The observations made after the accident—all tend to show that there was gradual emission or exudation of gas in 15 and 16 south levels of BI.10A incline—Gradual exudation means that the gas is discharged in countless little streams issuing from all joints and pores in the coal face. The quantity of accumulation may no doubt vary from place to place, depending on the circumstances existing at the place, and may also vary at different times, depending again on circumstances including weather conditions existing at the time; but the accumulation will be gradual and will take some time to reach the explosive limit. From the observations recorded in the present case, the accumulation was 2 per cent to 4 per cent on June 4, 1965, a little above 4 per cent on June 8, 1965, and about 9 per cent. to 11 per cent on June 26-27, 1965. There must have been a similar build up of gas to the explosive limit prior to the accident. This inference follows from the following circumstances—(i) the evidence on record eliminates all other probable sources of ignition except ignition of fire damp in 15 south level; (ii) coking at the face of 15 south level indicates flame explosion in that level; (iii) the direction of the blast indicates the seat of ignition in BI.10A incline; (iv) the presence of a dead body with burn injuries (without any signs of violence) and no clothes which must have been burnt; and lastly; (vi) a naked light (hurricane lantern) near the dead body. The accumulation of gas in 15 south level was facilitated by (a) lack of ventilation; (b) no movement of air as no work was being done in the gallery for the strike period and thereafter till the time of the accident; (c) dryness of the gallery; and (d) proximity of the crushed zone of the Gobindapur-Pichri fault (to which a reference has been made earlier) through which gas might easily migrate. In view of these circumstances it can be inferred with reasonable certainty in the present case that there was an accumulation of fire damp in 15 south level of BI.10A incline prior to the accident.

74. As to the second point, it is necessary to say a few words about the manner in which fire-damp is held in coal. It has been stated that the precise manner in which firedamp is contained in the 'solid' coal is not fully understood, but is generally regarded as being (a) partly in a state of *mechanical imprisonment* in

small cavities, breaks, and fissures, and (b) partly in a state of occlusion. To account for the presence of large quantities of gas, it is supposed that the gas is held in a state of occlusion in the molecular interspaces or absorbed on the surfaces of capillary passages within the solid substance. Faults are frequently associated with large quantities of gas, probably because of the existence of soft and disintegrated coal in their neighbourhood and also because they may communicate with several seams. As a rule, firedamp is more prevalent in deep mines than in shallow mines (although not invariably so). Natural ventilation which depends on weather conditions has also a bearing on the accumulation of firedamp by gradual emission; if ventilation improves, that gas will be diffused and such diffusion will prevent layering or accumulation.

75. In the present case, it is not difficult to explain why at the end of the first week in July the accumulation of gas became almost nil. Firstly, the ventilation improved as a result of weather conditions and secondly, the source from which firedamp was exuding may have been exhausted. Such a phenomenon is not unknown in the mining industry, and does not necessarily indicate that there could have been no exudation of gas prior to the accident.

76. From a study of barometric pressure (see Plate III) it would be observed that there had been both rising as well as falling barometer pressures during the post-explosion period—from May 29 to June 27, 1965, thus affecting the accumulation of gas in accordance with the rise and drop in pressure. In a naturally ventilated mine as in the present case, barometric pressure would play an important role in ventilation, especially, in view of the shallow depth (maximum—100 m.) of the mine, thus indirectly controlling gas build up. During the post-explosion period (May 29 to June 27, 1965), pressure had been on the lower side with nigh surface temperature, thus restricting underground ventilation, which facilitated accumulation of gas.

Contributory Causes of the Accident:

77. Having found the main causes of the accident, we proceed now to consider the contributory causes. These come primarily under two heads—(a) lack of ventilation plus the use of naked light in the mine, and (b) coal dust and the failure to treat it properly to prevent liberation and accumulation.

78. There can be no doubt that ventilation in 15 south level of BI.10A incline was extremely poor. The Dhori Colliery is a naturally ventilated mine. The depth of the dip-most workings is not very great. The mine has a number of openings, but as has been stated by the Management and it may be accepted as correct, there were three distinct air circuits in the mine, *i.e.*, one in each of the three inclines.

79. Natural ventilation can never be expected to be very dependable, nor can it be expected to circulate any fixed quantity of air around any working district or in each of the working faces, and more so when the workings are so shallow. Natural ventilation also changes the direction of air with the seasons. The ventilation is somewhat brisk and more air goes down the mine when the surface temperatures are low as in winter and during the rains. It is rather sluggish during the summer when the surface temperatures are high.

80. The accident occurred on the night of 27/28th May, 1965, days when, according to the records placed before us, the surface temperature had reached the highest. The mine was on strike for about 45 days and the explosion occurred seven days after the mine was re-started after the strike. The Manager had told R. G. Deo on June 4, 1965 that no work was being done in the 15 south level, and although this could be worked and was considered as a working place, no work was being done in this level and it was left to be worked in the rainy season when the main dip workings were likely to create great difficulties due to heavy percolation of water. In his evidence before us the Manager went back on his earlier statements to R. G. Deo and said that the statements were made due to perplexity of mind. In our opinion, the Manager was merely trying to go back on his earlier statements, which did not suit him at the time when he was giving evidence.

81. It is admitted that 15 South level had gone about 288 ft. from the south companion dip without any cross connection. The Manager was asked if the standard of ventilation was sufficient. The Manager referred to Regulation 130 of the Coal Mines Regulations, 1957 and said that as there was sufficient oxygen present in the air in 15 south level, the standard of ventilation required by the Regulation was maintained. The Manager even went to the length of saying that if 15 south level had been driven to a distance of 2000 ft. from the south

companion dip, the standard of ventilation required by Regulation 130 would still be maintained. In making these statements the Manager showed a degree of irresponsibility which appears to us to be surprising.

82. Regulation 130 requires that it shall be the duty of the owner, agent or manager of every mine to take such steps as are necessary for securing that there is constantly produced in all parts of the mine below ground which are not sealed off, ventilation adequate to clear away smoke and steam; to dilute gases that are inflammable or noxious so as to render them harmless; to provide air containing a sufficiency of oxygen; and to prevent such excessive rise of temperature or humidity as may be harmful to the health of persons. It is clear to us that sufficiency of oxygen is not the only test. It was the duty of the manager to see that there was ventilation adequate to dilute gases that are inflammable or noxious so as to render them harmless. We are not impressed by the argument that Regulation 130, so far as it relates to inflammable and noxious gases, does not apply to a non-gassy mine. The Regulation talks of every mine and makes no exception whatsoever. In driving the gallery to a distance of about 288 ft. (without a ventilation connexion) from the south companion dip, the manager undoubtedly failed to see that there was adequate ventilation within the meaning of Regulation 130 of the Coal Mines Regulations, 1957.

83. This failure contributed to the accumulation of fire-damp in 15 south level. Most probably, between 22nd of May and the 27th of May, 1965 no one had tried to enter the gallery and the accumulation of CH_4 in that gallery had never been noticed. It is not possible to say for how long the leakage had been taking place in the gallery. With a very small leakage and with men constantly going in and out, the quantity of CH_4 that would build up in the general atmosphere of the gallery would be small, and as the safety lamps were the only means of detecting the gases (*i.e.*, if any body ever actually checked for gas in this mine) percentages below 2½ or 3 of CH_4 in the general body if air would not normally be detected.

84. Be that as it may, there be no doubt that ventilation in 15 south level was so poor that it facilitated the accumulation of firedamp. The mine was treated as a non-gassy mine and naked lights were used for illumination. The use of a naked light in an area where there is accumulation of firedamp up to the explosive limit is extremely dangerous.

85. As to accumulation of coal dust, even R. P. Sinha had said in his evidence: "It would be correct to say that there was presence of profuse coal dust in the colliery". The question is was this coal dust treated in the manner required by Regulation 123(4) and 123(5)(a) and (b) of the Coal Mines Regulations, 1957. We have already said that the analysis of the dust samples taken after the accident showed a failure to mix the dust with incombustible matter as required by the Regulation. Clause (4) of the Regulation requires that in every part of a mine which is not naturally wet throughout the floor, roof and sides of the workings shall, as far as practicable, be kept clear of any accumulation of coal dust. It appears that this clause of the Regulation was also not enforced in the Dhori Colliery.

86. R. G. Deo says in his report that he was informed that the Safety Officer (one R. B. Jha) of the Colliery used to analyse dust samples in the colliery laboratory. The registers showing the analysis could not, however, be produced before R. G. Deo. They were produced on June 1, 1965. We have examined these registers and they seem to be all written at one sitting. There are over-writings which also appear to be suspicious. At a late stage, the Management examined one B. N. Pathak to prove that some lime-stone had been purchased from him between December 1964 and March 1965. B. N. Pathak proved some vouchers, but did not produce his cash book or sales book to prove the sale of lime-stone. In any case, the mere purchase of lime-stone from December 1964 to March 1965 would not show that the coal dust was being properly dealt with in accordance with the provisions of Regulation 123 of the Coal Mines Regulations, 1957.

87. Safety Week inspection reports of January 1965, produced by the Management, give us an impression that while no arrangements were made in the mine (which was considered by the inspecting teams as a dry mine) for wetting the coal dust at the working faces, the coal dust had been cleaned properly and the working districts were satisfactorily treated with incombustible dust. It is quite likely that these inspecting teams had moved round a few working places only and their report does not necessarily mean that the other working places and roadways in the mine were also cleaned and treated with incombustible dust. It is, however, possible, and indeed it is very probable, that both before and after the safety week, little or no work was done in this mine either on the

coal dust cleaning or on spreading the incombustible dust We are aware that in a mine working on pillar and gallery method, it may not be possible to keep all the miles and miles of galleries underground completely free of coal dust But if all the required precautions are taken systematically and thoroughly at the working faces and inside all the roads in working districts as well as on all the transport and travelling roads, the danger of dust explosion will be greatly minimised Unfortunately, in the Dhori Colliery, proper precautions against accumulation and liberation of coal dust were not taken, and the presence of profuse coal dust in all parts of the mine, as noticed by R P Sinha himself, was one of the contributory causes of the accident

Other Circumstances Attending the Accident:

88. One of the circumstances which has been emphasised before us on behalf of the Trade Unions is that the Attendance Registers were not kept properly with the result that, it is possible to ascertain, with absolute certainty, how many people were underground at the time when the accident took place The evidence of the Assistant Manager shows that the third shift was to have commenced at 1 30 A M, the three shifts being—(1) 9 30 A M to 5 30 P M; (2) 5 30 P M to 1 30 A M; and (3) 1 30 A M to 9 30 A M He further admits that though the register showed that the men of the third shift had gone in at 1 30 A M, some of these men were caught in the explosion It follows therefore that the attendance registers did not correctly show the time of attendance and some men of the third shift were permitted to go underground even earlier than 1 30 A M The Manager admitted that the casualties were heavy because some men of the second shift had not come out when men of the third shift had gone in The Manager said that he was absent on the day of the accident and could not say under whose orders about 163 people of the third shift were permitted to enter underground before time

89 It is clear from the above that the attendance registers were not properly kept and one of the reasons why there were heavy casualties was the circumstance that some men of the second shift had continued to stay underground after the time when they should have come out or some men of the third shift had gone underground before time This shows lack of supervision resulting in actual overlapping of shifts and amounts to violation of Sections 36 and 48 of the Mines Act, 1952 and Rule 78 of the Mines Rules 1955

90 Another circumstance which has been brought out in the evidence is the following Under Regulation 36(1)(b) where the mine is worked on more than one shift the owner agent or the manager shall arrange that during the afternoon shift and the night shift the mine is under the general supervision of an under-manager or assistant manager if any, and of an experienced overman in other cases The duties and responsibilities of an overman are laid down in Regulation 43 One of his duties is that he shall at the end of his shift record in a bound-paged book kept for the purpose a general report on the performance of all his duties during the shift including anything concerning the proper working of the mine and the safety and discipline of persons employed in his district Under Regulation 34(1) at every mine one or more overmen shall be appointed to hold charge of the different districts of the mine *on each working shift*

91. The evidence of the Manager shows that the position in Dhori Colliery was as follows: for each shift there were three mining sirdars: so far as overmen were concerned, the position was that in the first shift there would be four overmen and they would work only for five hours in the morning shift: for the next shift they would work for three hours and for the last shift that is the night shift, they would work only if any emergency required their presence The Overmen's reports which have been filed in Court Exhibit XX show however, that they were working continuously for 8 hours shiftwise It is obvious from the evidence given that Regulations 34 and 43 were not strictly complied with This showed a lack of proper supervision

92 A third circumstance which has been brought out in the evidence is that the plans required to be maintained under Regulation 59 of the Coal Mines Regulations, 1957 were not kept up-to-date. Under that Regulation, geological features of the area of the mine are to be shown on all underground plans The underground plans which were kept in the Dhori colliery did not show the Gobindapur-Pichri fault; nor were the other plans kept up-to-date Under Regulation 62(2), every plan or section or any part thereof prepared by or under the supervision of a surveyor shall carry thereon certificate by him to the effect that the plan or section or part thereof is correct; and shall be signed and dated by the surveyor and countersigend and dated by the manager on every occasion that the plan or section is brought up-to-date It appears that the working plan of the Bermo seam was not countersigned by the Manager after September 17, 1963, although the plan had been brought up-to-date as on March 20, 1965

93. Under Regulation 41(1) of the Coal Mines Regulations, 1957, the manager shall exercise daily personal supervision and in case of workings below-ground he shall visit and examine the workings below-ground on at least four days in every week to see that safety in every respect is ensured. It appears that the Manager did not visit and examine the workings below ground on at least four days every week to see that safety in every respect was ensured. It may be pointed out, however, that the proviso to the Regulation states that when owing to any unavoidable cause the manager is unable to carry out the aforesaid duties or inspections, he shall record the reason for the same in the book kept for the purpose. We cannot, therefore, hold that there was a clear violation of Regulation 41.

94. Regulation 141(2)(a) says that the first inspection of a mine or part which is re-opened after a discontinuance of mining operations for a period exceeding seven days shall be made by a competent person with an approved flame saftey lamp; and during such inspection, no additional light or lamp other than an approved electric torch or lamp shall be used. Clause (b) of the said Regulation says that the result of every such inspection shall be recorded in a bound-paged book kept for the purpose and shall be signed and dated by the person making the inspection, and countersigned and dated by the manager. R. G. Deo giving evidence on behalf of the Department of Mines said that Regulation 141(2)(a) and (b) did not apply in the present case, because though the mine was not worked for 45 days on account of the strike, pumping and statutory inspections were being made from time to time; therefore, the mine was really open and was not "discontinued" within the meaning of Regulation 141(2)(a). R. G. Deo further said that the interpretation which he put on the expression "discontinuance of mining operations" was not an authoritative interpretation, but was a matter of convention which had been accepted by the managements of mines. We consider that this is a matter which should be authoritatively settled. If BI.10A incline were inspected by a competent person with an approved flame safety lamp after the end of the strike, it might have been possible to detect the accumulation of firedamp in 15 south level.

95. There is one other circumstance to which we must make a reference before we conclude this part of the case. The evidence of V. P. Parti, Inspector of Mines, shows that he inspected the Dhori Colliery on the 22nd, 23rd and 24th of July, 1964. This was the last detailed inspection by an officer of the Inspectorate prior to the accident. During that inspection, V. P. Parti found accumulation of dry coal dust all along the haulage incline and also near some of the working faces. A violation report was sent to the Management in September, 1964, and a reply was received in December, 1964 to the effect that the dry coal dust along the haulage incline and near the working faces had been cleared. No further action was taken by the Inspectorate in the matter of the accumulation of coal dust in the Dhori Colliery.

96. V. P. Parti was cross-examined on the point and he said that he did not check the correctness of the report sent by the Management because he thought that he would do the verification on his next underground inspection. R. G. Deo was also cross-examined on the matter and he said that the Inspectorate pursues a violation report only when it relates to a serious matter; otherwise, the Inspectorate is satisfied with the rectification report sent by the Management.

97. We realise that it is the management which runs the mine, and it is not the duty of the Inspectorate to run or manage a mine. Nor can it be expected that the Inspectorate would look into every nook and cranny of a mine. Yet we think that accumulation of coal dust in a mine like the Dhori Colliery was a serious matter and required greater vigilance.

PART II

General Observations and Recommendations:

98. This brings us to an end, so far as the main scope of our enquiry is concerned. The chief aim of an enquiry like the one which we have conducted is to ascertain what has happened, that is, to ascertain the causes of the accident and circumstances attending it. But it has been well-recognised in the past that one of the purposes of such an enquiry is to eliminate, as far as practicable, similar causes for the future. This calls for the active co-operation of all parties. We may be permitted, therefore, to make certain general observations, arising out of the evidence given before us, which we feel have a bearing on the question of preventing a recurrence in future of a disaster of this nature.

99. Naked lights were allowed in the Dhori colliery, because it was treated as a non-gassy mine. The Chief Inspector of Mines had drawn our attention to his Circular No. 11 of 1962, dated 12th March, 1962. That circular requires certain

categories of workers employed belowground in coal mines to be provided with efficient electric lamps of a type approved by the Chief Inspector. The categories of workers to be provided with electric lamps include overmen, sirdars and other members of the supervisory staff, and also all miners, loaders and other workers belowground. So far as other workers belowground are concerned, the date by which they should be provided with electric lamps was mentioned as 31st December, 1964. We were given to understand that the date was later changed to 31st December, 1965. We are of the opinion that even in non-gassy mines, all workers belowground should be provided with electric cap lamps. This will greatly minimise the danger of gas explosion underground. If electric cap lamps had been in use in the Dhori Colliery, the accident perhaps would not have occurred. When a mine is treated as non-gassy, a sense of complacency generally creeps in. This sense of complacency can be dangerous, as has been shown by the accident in the Dhori Colliery.

100. Circular No. 52 of 1962, issued by the Chief Inspector of Mines, classifies seams according to their gassiness as "actively gassy", "potentially gassy" and "technically gassy". There is no difficulty about "actively gassy" and "technically gassy" seams. The evidene led before us has given rise to a difficulty about "potentially gassy" seams. The declaration of seam as a "potentially gassy" seam depends on a gas survey carried out in the workings of the mine. The gas survey includes checking for gas and collecting air samples from the general body of air as well as boreholes put in the workings specially for the purpose. The evidence of R. G. Deo, Additional Chief Inspector of Mines, gives one the impression that the survey referred to above is to be made by the Inspectorate occasionally. In the course of arguments before us, the Chief Inspector of Mines submitted that the survey had to be made by the management. So far as the Dhori Colliery is concerned, no such survey was made. We consider it necessary that the position should be made clear as to which authority will conduct the survey contemplated by Circular No. 52 of 1962. Such a survey assumes very great importance when the working in a seam are in the vicinity of an area affected by geological disturbances.

101. Regulation 124 of the Coal Mines Regulations, 1957 lays down that in a mine where safety lamps are not required to be used by or in pursuance of the Regulations, if any working has approached within 30 metres of a known dyke, default or other geological disturbance, the competent person appointed to make inspections shall, during the course of such inspections, test for the presence of inflammable gas with an approved flame safety lamp. It is a matter for consideration if the limit of 30 metres laid down in the Regulation is a safe limit or not and we recommend that it be considered in consultation with the Geological Survey of India.

102. It is well known that even a very experienced man cannot always detect, with a safety lamp CH_4 in a mine working, if the percentage of CH_4 in the atmosphere is less than 2. An ordinary sirdar, even if he keeps in touch with gas testing in a laboratory, is not likely to detect gas unless the percentage in the atmosphere is over 2·5.

103. In our opinion, in future, all the mining sirdars, the shot firing sirdars, and the overmen should be trained to detect the presence of CH_4 in the mine atmosphere. We also recommend that this endorsement for gas testing on the certificate of *all* the mining sirdars, the short firing sirdars and the overmen should be revalidated periodically. Necessary steps should be taken to ensure that all such persons who do not possess gas testing endorsements on their certificates get this endorsement within a reasonable period.

104. Whenever flame and/or electric safety lamps are used in any mine, gassy or non-gassy, the proper maintenance of these lamps in good and safe working condition should be the duty and responsibility of the management of the mine.

105. As to the accumulation of coal dust, we have already stated that this is a serious matter and any violation of the necessary precautions against coal dust as laid down in Regulation 123 of the Coal Mines Regulations, 1957 must be pursued vigorously and relentlessly if the danger of coal dust explosion is to be minimised. If the acceptance of this recommendation necessitates the strengthening of the staff of the Inspectorate, we are clearly of the opinion that the staff should be strengthened: because coal dust explosions are the greatest danger to the mining industry and such explosions are almost invariably initiated by firedamp explosions and these require (a) the presence of an explosive firedamp-air mixture; (b) a source of ignition, and (c) a length of road-way or face unprotected against the propagation of an explosion.

106. In some countries the danger of coal dust explosions, particularly in gassy mines, has been sought to be minimised by the erection of stone-dust barriers. There are two types of barriers known as "light barriers" and "heavy barriers". The question whether such barriers can be introduced in non-gassy mines was casually referred to before us. We did not, however, hear the parties in full on this question and we leave it to the Department of Mines to consider the suitability of introducing such "barriers" in these mines in this country in the light of all the relevant factors, including expense. We have particularly in mind the introduction of stone dust barriers in those connections between widely separated areas like the two connections between the BI. 10 incline and the Amlo incline and one connection between the BI.10A incline and the BI.10 incline. Such connection may not be necessary for mining purposes, but are made only for administrative convenience.

107. We further consider that the psychological difference in the minds of the workers, the officers and the management between a gassy and a non-gassy mine is so enormous that once a mine is considered non-gassy, it is presumed that there exists no danger of explosion and that no special precautionary measures are required to be taken. While we consider that it will be a wrong remedy to declare all the mines as gassy mines, we strongly feel that it is time that some common precautions should be introduced in all the mines, gassy and non-gassy, especially in the working faces. Leaving the important task of testing for gas entirely in the hands of the present day sirdars, overmen and with the help of a safety lamp, is certainly not very safe. Every mine must be required to test for gas in each working face and also in all places within a distance of, say, 300 ft. from the working face by means of a more accurate and a more sensitive instrument than a safety lamp or by analysis of samples of air. This can be done once a month or oftener and by an assistant manager or the manager, possessing either a second class Manager's certificate or a first class Manager's certificate. If this work is divided between the manager and the assistant managers in a colliery, it can be done easily, systematically and regularly.

108. When a mine is naturally ventilated, the law does not even require the manager to arrange for taking regular measurements of air going into the different districts. Thus, the manager has no idea as to how much of air goes down in a mine, how much of it leaks out to the return side, and how much of it actually finds its way to the working faces. In gassy mines, under the present law, the whole mine has to be ventilated by a mechanical ventilator fixed on the surface. We consider that even in non-gassy mines, steps should be taken to ensure better ventilation.

109. We understand that the Technical Committee on Mines Safety Standard has already made some recommendations regarding standard of ventilation in non-gassy, gassy and very hot mines, which were circulated by the Chief Inspector of Mines in his Circular No. 11 of 1964. The Committee had also recommended that the ventilation standards should be prescribed in the Mines Regulations themselves. This question may now be seriously considered. In case of a naturally ventilated mine, it is practically impossible to achieve the standard as recommended by the Technical Committee. As such, in the Regulation itself, the term 'adequate ventilation' should be explained in fuller detail incorporating the quantity of air etc. as specified in the Committee's recommendation.

110. Non-gassy mines, which are very small or at their initial stage of development and for which a special relaxation should be obtained from the Inspector of Mines in writing, may be allowed to depend entirely on natural ventilation. Even in such mines, the relaxation should be renewed every year by the Inspectorate after inspection. In other non-gassy mines, the velocity of air current in the development workings should be maintained at not less than 0·5 m. per second. It is understood that in the case of a good, naturally ventilated mine, no mechanical means of ventilation is necessary. In case the natural ventilation does not meet the above requirement, auxiliary fans in the main return way, or a fan on the surface with suitable capacity should be installed.

111. Another thing that must be enforced is the distance to which a gallery can be driven "blind'. Normally, it should be obligatory to make ventilation connections as soon as the gallery is driven a pillar and a half length or 150 ft. from the last ventilation connection, whichever may be more. Special exemption may be given by the Chief Inspector of Mines, where necessary, to exceed the limit.

112. The Safety Week idea, introduced by the present Chief Inspector of Mines, is a very good idea; but it is liable to be mis-used. Safety weeks should

not be used only to win prizes by making special efforts during a few weeks just before the safety week commences and then completely relaxing and neglecting all the safety precautions afterwards. But the Safety Week should be utilised for the purpose for which it was introduced, namely, to emphasise special aspects of safety and to make every one safety-conscious, to make workers more safety-minded and to impress on every body that safety is a common concern of all who work in the mines and not only of the statutory staff and of Mines Inspectors.

113. Certain other suggestions for preventing a recurrence of a disaster like the one that occurred in the Dhori Colliery were also made before us, such as (a) nationalisation of coal mines; (b) nationalisation of sirdars and overmen; (c) discharge, dismissal and suspension of managers and assistant managers with the consent in writing of the Chief Inspector of Mines; (d) the creation of a pool of technical and competent persons, etc. These suggestions raise very broad and general questions, involving many considerations regarding which no evidence has been given before us. Therefore, we have not thought fit to examine these suggestions and we make no recommendations with regard to them.

114. As to rescue operations, we have two suggestions to make. The Log books of the Rescue teams were produced before us. They contained many overwritings and erasures. Some members of some of the Rescue teams took air samples which were subsequetly sent for analysis. It was difficult to make out from the Log Books the particular places from where the air samples were taken. We consider that in future there should be a better distribution of work amongst different teams who are called upon to carry on these early operations; those who are entrusted with the duty of taking air samples must make clear entries showing the particular place or places from which samples are taken. Other teams who are busy with rescue or recovery operations, should not be entrusted with the task of taking air samples. The log books should be printed books with appropriate columns so that they would show at a glance what work has been done and at what place in the mine. It is important that during these early operations no vital evidence is destroyed, or opportunity to make valuable observations lost. It is equally important that evidence is not gathered in such a way that confusion is caused at a later stage. It is also important that adequate facilities for a scientific analysis of air samples are provided as expeditiously as possible, during these early operations.

115. A suggestion was made before us that there should be a Rescue Station within a radius of five miles from each mine. We did not exaimne the suggestion, because the entire scheme of Rescue stations was not under consideration before us.

116. We must, however, express our appreciation of the way in which recovery operations were carried out as effectively and as expeditiously as was possible in the circumstances which prevailed after the accident in the Dhori Colliery. These operations were carried out under great stress and difficulty. Unfortunately, there was no survivor underground. There was commendable co-operation of almost the entire mining community in these early operations; even the recovery of such a large number of dead bodies presented difficulties which were met by the combined efforts of all.

117. Another suggestion which was made before us related to the indentification of dead bodies. A number of dead bodies could not be identified in the present case. The Chief Surveyor showed in a plan prepared by him the places where dead bodies were found and gave certain numbers to the dead bodies. The post-mortem examination on the dead bodies was done by a number of doctors and either the numbers given to the dead bodies on pasted slips of papers were lost or the numbers were not known to the doctors. The result was that except for one doctor, the other doctors followed their own numbering and it was difficult to identify the particular dead body on which the post-mortem examination was made.

118. The Department of Mines may well consider whether some sort of a brass token should not be given to each worker in a mine. The token may be worn round the neck by means of a thread or may be carried as an armlet. If our recommendation about the use of electric cap lamps is accepted, identification would become easier; because each cap lamp bears a number and a register must then be kept showing the number of the cap lamp issued to each worker. We are making no specific recommendation on this point; but are suggesting that the matter should be considered by the Department of Mines so that identification of the workers, after a big accident, may not create difficulty or confusion.

Rule 22 of the Mines Rules, 1955—Recovery of Expenses:

119. We have been addressed on the question of recovery of expenses under Rule 22 of the Mines Rules, 1955. The Rule is not as clearly worded as one might wish and certain difficulties of interpretation have arisen in respect of it. It is clear enough from the Rule that the condition precedent for the recovery of expenses thereunder is that the Court of Inquiry must find that "the accident was due to any carelessness or negligence on the part of the management". The expression "management" has not been defined in the Mines Act or the Rules made thereunder, but Rule 46 indicates that the expression includes managers, undermanagers and others who hold a position of supervision or management. The expression "owner" is defined in Section 2 of the Mines Act and it states *inter alia* that any contractor for the working of a mine or any part thereof shall be subject to the Act in like manner as if he were an owner, but not so as to exempt the owner from any liability. Under the old rule, a court of inquiry after finding that the accident was due to carelessness or negligence on the part of the management could order the owner, agent or manager to pay all or part of the expenses of the inquiry. In case of failure, the amount so directed could be recovered by the distress and sale of any movable property belonging to owner, agent or manager. In the new rule the words "agent of or manager" have been intentionally omitted and this omission now makes the owner liable to pay all or part of the expenses of the inquiry even though the accident may be due to the fault of agent or manager.

120. So far there is no difficulty. The difficulty arises when one considers the ambit or scope of the Rule. What does the expression "expenses of the inquiry" mean? Does it contemplate the recovery of expenses which the parties, several in number, have incurred in the enquiry including the fees of their lawyers, or does it contemplate the expenses which the appointing authority has incurred in appointing the Court of Enquiry and Assessors under S.24 of the Act and in the proceedings before it. Reading the Rule as a whole, the latter seems to us to be the true scope of the Rule. In the Newton Chickli court of inquiry, V.R. Sen J., (as he then was) said, "This rule does not contemplate award of costs to parties in the enquiry. The expenses of the enquiry, in my opinion, refer to expenses incurred by Government in connection with the enquiry. These include the expenses of summoning witnesses, in paying the travelling allowances of the court and of the assessors and payment to the staff and other incidental expenses. It may be pointed out that the expression 'costs' has not been used in the Rule There is another reason why the expression referred to in the rule cannot include costs incurred by a party. There is no machinery by which a private party can recover costs awarded to it". In the Amlabad enquiry, B. P. Jamuar J. (as he then was) said. "The expression 'expenses of the inquiry' used in Rule 22(1) of the Mines Rules 1955 means 'expenses of the court of inquiry'. Accordingly, the expenses incurred by the Mines Department for the court of "inquiry will legitimately come within the meaning of the Rule 22(1) of the Mines Rules, 1955 but not the expenses incurred by the parties".

121. The Rule does not lay down any method by which the expenses are to be calculated. In ordinary litigation costs follow the event, and the successful party gets costs according to rules of the Court laid down for the purpose. Rule 22 seems to leave to the Court of Enquiry to specify the manner or method of determining the expenses as also the time within which the payment is to be made. One view which has been expressed is that the Court of Enquiry is not a Court of permanent jurisdiction; it becomes *functus officio* on the submission of its report under sub-s. (4) of S. 24, and no order can, therefore, be made under Rule 22 after the submission of the report. The other view is that the Court of Enquiry retains jurisdiction to work out its own order as to the recovery of expenses, and quantification of the expenses being a mere ministerial act, can be made subsequently by the person who is appointed to hold the inquiry. This latter view must now be accepted as correct, because it was approved by the Supreme Court in S. S. Grewal *v.* Bhowra Kankanee Collieries Ltd. 1963 B.L.J.R. 133 The Supreme Court has held that the Court of enquiry does not become *functus officio* after submission of its report and is competent to quantify the expenses later on in accordance with the direction contained in the report of enquiry and that the order quantifying the expenses is an order of a miner ministerial nature, with which the assessors are not required to be associated.

122. From the findings which we have given, it is clear that the accident was due to the negligence on the part of the management in the matter of (a) failure to take precautions against coal-dust as laid down in Regulation 123, and (b) failure to maintain the standard of ventilation as required by Regulation 130 in respect of 15 south level of BI.10A incline which was driven to a distance of 288 ft. without any cross-connection. The accident was caused by a firedamp explosion initiating a coal-dust explosion It was what is called "a truly joint explosion".

123. Under Rule 22 of the Mines Rules, 1955 the Court of Enquiry directs the owners of the mine to pay part of the expenses of enquiry, namely, to the extent of two-thirds of the expenses incurred. No statement of expenses has been filed before us by the appointing authority or the Chief Inspector of Mines. The expenses will be quantified after a statement of expenses has been filed and scrutinised by the Court. The amount directed to be paid by the owners will be divided equally between (1) Messrs. Bokaro & Ramgur Ltd., and (2) Messrs. Sarangarh Coal Co. (Dhori), the Raising-*cum*-Selling Contractors, who are both owners within the meaning of the definition given in S. 2(1)(1) of the Mines Act, 1952. The payment must be made within six months from the date of the quantification of the amount.

Conclusion

124. In conclusion, we must record our sense of appreciation of the assistance given to us by the parties and their legal representatives. We consider it a matter of great satisfaction that the parties fully co-operated with us during the enquiry and that all of them helped in keeping politics and irrelevant matters out of the inquiry.

125. The Court of Enquiry also records its sense of appreciation of the services rendered by the staff placed at the disposal of the Court of Enquiry. The members of the staff have rendered ungrudging and untiring services. The Secretary to the Court of Enquiry (Prem Gopal Mathur) had to bear a very heavy burden, and he performed his duties with exceptional industry and devotion to duty.

126. We append to this Report (i) copies of the proceedings of the Court (Appendix I), (ii) depositions of witnesses (Appendix II), (iii) Statements of the Case filed by the parties (Appendix III), and (iv) reports submitted by R. P. Sinha (Appendix IV).

127. All bulky documents including Exhibits, plans and maps, have been made over to the Chief Inspector of Mines.

128. The plates have been prepared with the assistance of the Geological Survey of India, for which our thanks are due to them.

(Sd.) S. K. DAS,
Court of Enquiry,
Dhori Colliery Accident.

Assessors:

1. (Sd.) P. K. GHOSH
2. (Sd.) S. C. DEY
3. (Sd.) B. H. ENGINEER.

November 26, 1965.

[No. 2/25/65-MI.]
N. N. CHATTERJEE, Jt. Secy.

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